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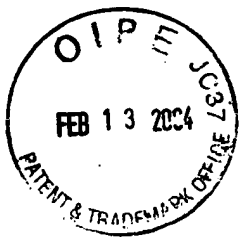

PATENT
Atty. Dkt. No. AMAT/4714.D1/CPI/VCVD/PJS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Kori, et al.

Serial No.: 09/625,336 — Group Art Unit: 1763

Confirmation No.: 7523 — Examiner: Karla A. Moore

Filed: July 25, 2000

For: Method and System for Controlling the Presence of Fluorine in Refractory Metal Layers

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2/9/04 (Date) — Kurt R. Zhon (Signature)

Dear Sir:

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1763 dated September 9, 2003, finally rejecting claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30. Please charge the fee of $320.00 for filing this brief to Deposit Account No. 20-0782/AMAT/4714.D1/KMT. Three copies of this brief are submitted for use by the Board.

Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

02/19/2004 TLUU11 00000091 200782 09625336
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Related Appeals and Interferences

Appellant asserts that no other appeals or interferences are known to the Appellant, the Appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30 are pending in the application. Claims 1-20 were originally presented in the application, and claims 1, 2, 4, 7, 8, 10, and 13 were subsequently amended. Claims 21-30 were added by amendment before the Final Office Action dated September 9, 2003. Claims 5, 6, 9, 11, 14-22, and 24-25 have been canceled. Claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30 stand rejected in view of several references as discussed below. The rejection of claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30 based on the cited references is appealed. The pending claims are shown in the attached Appendix.

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No amendments to the claims were submitted after the final rejection. Arguments presented after final rejection were not accepted by the Examiner.

Summary of Invention

The present invention generally provides a method and apparatus for depositing layers on a substrate by atomic layer deposition. The layers are chemisorbed on a substrate from a first compound and a second compound, wherein the second compound has fluorine atoms associated therewith (p. 3, lines 20-22). The first and second compound are introduced sequentially into a processing chamber with a carrier gas, such as hydrogen, nitrogen, or argon (p. 12, claim 10, lines 1-7, p. 3, lines 26-28). The amount of fluorine in the deposited layers may be controlled as a function of the carrier gas used (p. 12, claim 10, lines 8-10). In one aspect, hydrogen is used as the carrier gas to reduce the amount of fluorine in the deposited layers (p. 3, lines 25-28).

A purge gas is used to purge the chamber between the introduction of the first compound and the second compound (p. 12, claim 10, line 11 to claim 11, line 2). In one aspect, the purge gas may differ from the carrier gas (p. 9, lines 11-12). In one

embodiment, the purge gas is comprised of argon and the carrier gas is comprised of nitrogen (p. 9, lines 12-14). In another embodiment, the purge gas is comprised of argon and the carrier gas is hydrogen (p. 9, lines 18-20).

Issues Presented

1. Whether the Examiner erred in rejecting claims 1-4, 7, 8, 10, 12, 13, and 23 under 35 U.S.C. § 103(a) as being unpatentable over *Werkhoven, et al.* in view of *Jurmann*.

2. Whether the Examiner erred in rejecting claims 26 and 28 under 35 U.S.C. § 103(a) as being unpatentable over *Werkhoven, et al.* in view of *Jurmann*.

3. Whether the Examiner erred in rejecting claims 27, 29, and 30 under 35 U.S.C. § 103(a) as being unpatentable over *Werkhoven, et al.* in view of *Jurmann*.

Grouping of Claims

Pending claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30 do not stand or fall together for all arguments presented by Applicants. Applicants' first argument relates to the first issue for claims 1-4, 7, 8, 10, 12, 13, and 23, and claim 1 is representative of the claims. Applicants' second argument relates to the second issue for claims 26 and 28, and claim 26 is representative of the claims. Applicants' third argument relates to the third issue for claims 27, 29, and 30, and claim 27 is representative of the claims.

ARGUMENT

I. THE EXAMINER ERRED IN REJECTING CLAIMS 1-4, 7, 8, 10, 12, 13, AND 23 BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES

INTRODUCING A PURGE GAS INTO THE CHAMBER, WHEREIN THE PURGE GAS AND THE CARRIER GAS HAVE DIFFERING CONSTITUENTS, AS RECITED IN CLAIM 1.

Claims 1-4, 7, 8, 10, 12, 13, and 23 stand rejected under 35 U.S.C. § 103(a) over *Werkhoven, et al.* (U.S Patent Publication No. 2001/0041250) in view of *Jurmann* (U.S. Patent No. 5,167,735) on grounds that it would have been obvious to use nitrogen or argon as a purge gas, as described in *Jurmann*, with hydrogen or helium as the carrier gas in the process of *Werkhoven, et al.*

The Examiner acknowledges that neither *Werkhoven, et al.* nor *Jurmann* teaches using two differing gases as a purge gas and a carrier gas. However, the Examiner asserts that as *Werkhoven, et al.* provides a list of carrier gases, *i.e.*, hydrogen, nitrogen, argon, and helium, some of which are different than the purge gases of *Jurmann*, *i.e.*, nitrogen and argon, the combination of *Werkhoven, et al.* and *Jurmann* fairly teaches a process in which a purge gas and a carrier gas having differing constituents is used. Applicants respectfully traverse the rejection.

Werkhoven, et al. describes depositing thin films in a chamber by an atomic layer deposition process using alternating pulses of different reactant gas sources that are introduced into the chamber with a carrier gas (paragraphs [0062-0067]). *Werkhoven, et al.* describes purging the chamber between pulses of different reactant gas sources by continuing the flow of carrier gas between the pulses of reactant gases (paragraph [0065]). *Werkhoven, et al.* provides hydrogen, nitrogen, argon, and helium as possible carrier gases.

Jurmann describes purging a chamber during a de-oxidizing pre-treatment of steel before annealing steel (column 4, lines 39-61). *Jurmann* teaches purging the chamber with nitrogen or argon because nitrogen and argon are inert, relatively trouble-free and inexpensive gases (column 2, lines 39-43). However, *Jurmann* does not teach or suggest using a carrier gas in the processes described therein.

Applicants submit that the combination of *Jurmann*, which provides a method that includes a purge step using argon or nitrogen for de-oxidizing steel, and *Werkhoven, et al.*, which describes depositing alternating layers on a substrate from pulses of different reactant gases introduced into a chamber with a carrier gas of hydrogen, nitrogen,

argon, or helium and purging the chamber between pulses by continuing the flow of the carrier gas does not teach or suggest a method of chemisorbing alternating monolayers of a first compound and a second compound on a substrate in a chamber, with each of the first and second compounds being introduced into the chamber with a carrier gas, and purging the chamber with a purge gas having differing constituents than the carrier gas following chemisorption of each monolayer. While *Jurmann* describes advantages of using argon or nitrogen as a purge gas for a method of de-oxidizing steel that does not use carrier gases, *Jurmann* and *Werkhoven, et al.*, individually or in combination do not suggest or motivate using purge gases and carrier gases having differing constituents in a process for depositing alternating monolayers on a substrate.

Thus, Applicants submit that *Werkhoven, et al.* in view of *Jurmann* does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, as recited in claim 1. Applicants respectfully request withdrawal of the rejection of claim 1, and of claims 2-4, 7, 8, 10, 12, 13, and 23.

II. THE EXAMINER ERRED IN REJECTING CLAIMS 26 AND 28 UNDER 35 U.S.C. § 103(A) BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE

ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES INTRODUCING A PURGE GAS INTO THE CHAMBER, WHEREIN THE PURGE GAS IS ARGON AND THE CARRIER GAS IS NITROGEN, AS RECITED IN CLAIM 26.

Claims 26 and 28 stand rejected under 35 U.S.C. § 103(a) over *Werkhoven, et al.* (U.S Patent Publication No. 2001/0041250) in view of *Jurmann* (U.S. Patent No. 5,167,735) on grounds that *Werkhoven, et al.* and *Jurmann* teach the recited combinations of purge gas and carrier gas. Applicants respectfully traverse the rejection.

Werkhoven, et al. describes depositing thin films in a chamber by an atomic layer deposition process using alternating pulses of different reactant gas sources that are introduced into the chamber with a carrier gas, such as hydrogen, nitrogen, argon, or helium, and purging the chamber between pulses of different reactant gas sources by continuing the flow of carrier gas between the pulses of reactant gases (paragraphs [0061] and [0065]). The examples of *Werkhoven, et al.*, describe using nitrogen as the carrier gas and purging the chamber between pulses of reactants, such as by continuing the flow of the carrier gas (paragraphs [0061], [0065], [0125], and [0126]). There is no teaching or suggestion in *Werkhoven, et al.* to use argon as a purge gas and nitrogen as a carrier gas.

Jurmann describes purging a chamber with argon or nitrogen during a de-oxidizing pre-treatment of steel before annealing steel. *Jurmann* does not describe or suggest a process that uses both a carrier gas and a purge gas. In particular, *Jurmann* does not describe or suggest using argon as a purge gas and nitrogen as a carrier gas.

Thus, Applicants submit that the combination of *Werkhoven, et al.*, which describes using the same carrier gas and purge gas, with *Jurmann*, which describes a purge gas of argon or nitrogen in a substantially different process that does not include a carrier gas, does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing

chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, and the purge gas is argon and the carrier gas is nitrogen, as recited in claim 26. Applicants respectfully request withdrawal of the rejection of claims 26 and 28.

III. THE EXAMINER ERRED IN REJECTING CLAIMS 27, 29, AND 30 UNDER 35 U.S.C. § 103(A) BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES INTRODUCING A PURGE GAS INTO THE CHAMBER, WHEREIN THE PURGE GAS IS ARGON AND THE CARRIER GAS IS HYDROGEN, AS RECITED IN CLAIM 27.

Claims 27, 29, and 30 stand rejected under 35 U.S.C. § 103(a) over *Werkhoven, et al.* (U.S Patent Publication No. 2001/0041250) in view of *Jurmann* (U.S. Patent No. 5,167,735) on grounds that *Werkhoven, et al.* and *Jurmann* teach the recited combinations of purge gas and carrier gas. Applicants respectfully traverse the rejection.

Werkhoven, et al. describes depositing thin films in a chamber by an atomic layer deposition process using alternating pulses of different reactant gas sources that are introduced into the chamber with a carrier gas, such as hydrogen, nitrogen, argon, or helium, and purging the chamber between pulses of different reactant gas sources by continuing the flow of carrier gas between the pulses of reactant gases (paragraphs [0061] and [0065]). The examples of *Werkhoven, et al.*, describe using nitrogen as the

carrier gas and purging the chamber between pulses of reactants, such as by continuing the flow of the carrier gas (paragraphs [0061], [0065], [0125], and [0126]). There is no teaching or suggestion in *Werkhoven, et al.* to use argon as a purge gas and hydrogen as a carrier gas.

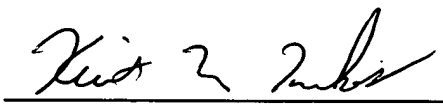
Jurmann describes purging a chamber with argon or nitrogen during a de-oxidizing pre-treatment of steel before annealing steel. *Jurmann* does not describe or suggest a process that uses both a carrier gas and a purge gas. In particular, *Jurmann* does not describe or suggest using argon as a purge gas and hydrogen as a carrier gas.

Thus, Applicants submit that the combination of *Werkhoven, et al.*, which describes using the same carrier gas and purge gas, with *Jurmann*, which describes a purge gas of argon or nitrogen in a substantially different process that does not include a carrier gas, does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, and the purge gas is argon and the carrier gas is hydrogen, as recited in claim 27. Applicants respectfully request withdrawal of the rejection of claims 27, 29, and 30.

Conclusion

In conclusion, *Werkhoven, et al.* and *Jurmann*, alone or in combination, do not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, the method comprising chemisorbing onto the substrate alternating monolayers of a first compound and a second compound, with the second compound having fluorine atoms associated therewith, with each of the first and second compounds being introduced into the processing chamber along with a carrier gas, purging the processing chamber following chemisorption of each of the alternating monolayers, wherein the purging the processing chamber includes introducing a purge gas therein, and controlling a quantity of the fluorine atoms associated with the monolayer of the second compound as a function of the carrier gas, wherein the purge gas and the carrier gas have differing constituents. Furthermore, *Werkhoven, et al.* and *Jurmann*, alone or in combination, do not teach, show, or suggest a process for depositing monolayers on a substrate, wherein a purge gas of argon and a carrier gas of nitrogen or hydrogen is used. Therefore, it is believed that the rejections made by the Examiner should be reversed. Thus, Applicants respectfully request reversal of the rejection and allowance of claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30.

Respectfully submitted,



Keith M. Tackett
Registration No. 32,008
MOSER, PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd. Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Attorney for Applicant(s)

APPENDIX

1. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas;

purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein; and

controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents.

2. (Previously Presented) The method of claim 1 wherein controlling said quantity of said fluorine atoms further includes selecting said carrier gas from a group of gases consisting of nitrogen (N_2), argon (Ar), hydrogen (H_2).

3. (Original) The method as recited in claim 1 wherein said first compound includes a boron-containing compound.

4. (Previously Presented) The method of claim 1 wherein said second compound includes a refractory metal selected from the group consisting of titanium (Ti) and tungsten (W).

7. (Previously Presented) The method as recited in claim 1 wherein purging said processing chamber includes pumping said processing chamber to evacuate all gases disposed therein.

8. (Previously Presented) The method as recited in claim 1 wherein purging of said processing chamber includes pumping said processing chamber clear of all gases disposed therein after introducing the purge gas.

10. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

serially exposing said substrate to first and second reactive gases, with said first reactive gas having a first compound associated therewith and said second reactive gas having a second compound associated therewith, to form alternating monolayers of said first compound and said second compound, with said second compound having fluorine atoms associated therewith;

controlling a quantity of said fluorine atoms associated with the monolayer of said second compound by introducing into said processing chamber a carrier gas along with said first and second reactive gases; and

purging said processing chamber following chemisorption of each of the alternating monolayers by introducing a purge gas, wherein the purge gas and the carrier gas have differing constituents.

12. (Previously Presented) The method as recited in claim 10 wherein purging said processing chamber includes pumping said processing chamber to evacuate all gases disposed therein.

13. (Previously Presented) The method as recited in claim 12 wherein said first compound includes diborane (B_2H_6) and said second compound is tungsten (W).

23. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

serially exposing said substrate to first and second reactive gases to deposit monolayers on the substrate, with said first reactive gas having fluorine atoms associated therewith;

controlling a quantity of said fluorine atoms associated with the monolayers by introducing into said processing chamber hydrogen (H_2) as a carrier gas along with said first and second reactive gases; and

purging said processing chamber following deposition of each of the monolayers by introducing a purge gas, wherein the purge gas and the carrier gas have differing constituents.

26. (Previously Presented) The method of claim 1, wherein the purge gas is argon and the carrier gas is nitrogen.

27. (Previously Presented) The method of claim 1, wherein the purge gas is argon and the carrier gas is hydrogen.

28. (Previously Presented) The method of claim 10, wherein the purge gas is argon and the carrier gas is nitrogen.

29. (Previously Presented) The method of claim 10, wherein the purge gas is argon and the carrier gas is hydrogen.

30. (Previously Presented) The method of claim 23, wherein the purge gas is argon.

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2/9/04 Kevin J. Zhao
Date Signature

Dear Sir:

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A purge gas is used to purge the chamber between the introduction of the first compound and the second compound (p. 12, claim 10, line 11 to claim 11, line 2). In one aspect, the purge gas may differ from the carrier gas (p. 9, lines 11-12). In one

embodiment, the purge gas is comprised of argon and the carrier gas is comprised of nitrogen (p. 9, lines 12-14). In another embodiment, the purge gas is comprised of argon and the carrier gas is hydrogen (p. 9, lines 18-20).

Issues Presented

1. Whether the Examiner erred in rejecting claims 1-4, 7, 8, 10, 12, 13, and 23 under 35 U.S.C. § 103(a) as being unpatentable over *Werkhoven, et al.* in view of *Jurmann*.

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ARGUMENT

I. THE EXAMINER ERRED IN REJECTING CLAIMS 1-4, 7, 8, 10, 12, 13, AND 23 BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES

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Jurmann describes purging a chamber during a de-oxidizing pre-treatment of steel before annealing steel (column 4, lines 39-61). *Jurmann* teaches purging the chamber with nitrogen or argon because nitrogen and argon are inert, relatively trouble-free and inexpensive gases (column 2, lines 39-43). However, *Jurmann* does not teach or suggest using a carrier gas in the processes described therein.

Applicants submit that the combination of *Jurmann*, which provides a method that includes a purge step using argon or nitrogen for de-oxidizing steel, and *Werkhoven, et al.*, which describes depositing alternating layers on a substrate from pulses of different reactant gases introduced into a chamber with a carrier gas of hydrogen, nitrogen,

argon, or helium and purging the chamber between pulses by continuing the flow of the carrier gas does not teach or suggest a method of chemisorbing alternating monolayers of a first compound and a second compound on a substrate in a chamber, with each of the first and second compounds being introduced into the chamber with a carrier gas, and purging the chamber with a purge gas having differing constituents than the carrier gas following chemisorption of each monolayer. While *Jurmann* describes advantages of using argon or nitrogen as a purge gas for a method of de-oxidizing steel that does not use carrier gases, *Jurmann* and *Werkhoven, et al.*, individually or in combination do not suggest or motivate using purge gases and carrier gases having differing constituents in a process for depositing alternating monolayers on a substrate.

Thus, Applicants submit that *Werkhoven, et al.* in view of *Jurmann* does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, as recited in claim 1. Applicants respectfully request withdrawal of the rejection of claim 1, and of claims 2-4, 7, 8, 10, 12, 13, and 23.

II. THE EXAMINER ERRED IN REJECTING CLAIMS 26 AND 28 UNDER 35 U.S.C. § 103(A) BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE

ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES INTRODUCING A PURGE GAS INTO THE CHAMBER, WHEREIN THE PURGE GAS IS ARGON AND THE CARRIER GAS IS NITROGEN, AS RECITED IN CLAIM 26.

Claims 26 and 28 stand rejected under 35 U.S.C. § 103(a) over *Werkhoven, et al.* (U.S Patent Publication No. 2001/0041250) in view of *Jurmann* (U.S. Patent No. 5,167,735) on grounds that *Werkhoven, et al.* and *Jurmann* teach the recited combinations of purge gas and carrier gas. Applicants respectfully traverse the rejection.

Werkhoven, et al. describes depositing thin films in a chamber by an atomic layer deposition process using alternating pulses of different reactant gas sources that are introduced into the chamber with a carrier gas, such as hydrogen, nitrogen, argon, or helium, and purging the chamber between pulses of different reactant gas sources by continuing the flow of carrier gas between the pulses of reactant gases (paragraphs [0061] and [0065]). The examples of *Werkhoven, et al.*, describe using nitrogen as the carrier gas and purging the chamber between pulses of reactants, such as by continuing the flow of the carrier gas (paragraphs [0061], [0065], [0125], and [0126]). There is no teaching or suggestion in *Werkhoven, et al.* to use argon as a purge gas and nitrogen as a carrier gas.

Jurmann describes purging a chamber with argon or nitrogen during a de-oxidizing pre-treatment of steel before annealing steel. *Jurmann* does not describe or suggest a process that uses both a carrier gas and a purge gas. In particular, *Jurmann* does not describe or suggest using argon as a purge gas and nitrogen as a carrier gas.

Thus, Applicants submit that the combination of *Werkhoven, et al.*, which describes using the same carrier gas and purge gas, with *Jurmann*, which describes a purge gas of argon or nitrogen in a substantially different process that does not include a carrier gas, does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing

chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, and the purge gas is argon and the carrier gas is nitrogen, as recited in claim 26. Applicants respectfully request withdrawal of the rejection of claims 26 and 28.

III. THE EXAMINER ERRED IN REJECTING CLAIMS 27, 29, AND 30 UNDER 35 U.S.C. § 103(A) BECAUSE *WERKHOVEN, ET AL.* IN VIEW OF *JURMANN* FAILS TO TEACH, SHOW, OR SUGGEST CHEMISORBING ONTO A SUBSTRATE ALTERNATING MONOLAYERS OF A FIRST COMPOUND AND A SECOND COMPOUND, THE SECOND COMPOUND HAVING FLUORINE ATOMS ASSOCIATED THEREWITH, WITH EACH OF THE FIRST AND SECOND COMPOUNDS BEING INTRODUCED INTO A CHAMBER ALONG WITH A CARRIER GAS, PURGING THE CHAMBER FOLLOWING CHEMISORPTION OF EACH OF THE ALTERNATING MONOLAYERS, WHEREIN THE PURGING INCLUDES INTRODUCING A PURGE GAS INTO THE CHAMBER, WHEREIN THE PURGE GAS IS ARGON AND THE CARRIER GAS IS HYDROGEN, AS RECITED IN CLAIM 27.

Claims 27, 29, and 30 stand rejected under 35 U.S.C. § 103(a) over *Werkhoven, et al.* (U.S Patent Publication No. 2001/0041250) in view of *Jurmann* (U.S. Patent No. 5,167,735) on grounds that *Werkhoven, et al.* and *Jurmann* teach the recited combinations of purge gas and carrier gas. Applicants respectfully traverse the rejection.

Werkhoven, et al. describes depositing thin films in a chamber by an atomic layer deposition process using alternating pulses of different reactant gas sources that are introduced into the chamber with a carrier gas, such as hydrogen, nitrogen, argon, or helium, and purging the chamber between pulses of different reactant gas sources by continuing the flow of carrier gas between the pulses of reactant gases (paragraphs [0061] and [0065]). The examples of *Werkhoven, et al.*, describe using nitrogen as the

carrier gas and purging the chamber between pulses of reactants, such as by continuing the flow of the carrier gas (paragraphs [0061], [0065], [0125], and [0126]). There is no teaching or suggestion in *Werkhoven, et al.* to use argon as a purge gas and hydrogen as a carrier gas.

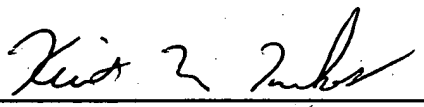
Jurmann describes purging a chamber with argon or nitrogen during a de-oxidizing pre-treatment of steel before annealing steel. *Jurmann* does not describe or suggest a process that uses both a carrier gas and a purge gas. In particular, *Jurmann* does not describe or suggest using argon as a purge gas and hydrogen as a carrier gas.

Thus, Applicants submit that the combination of *Werkhoven, et al.*, which describes using the same carrier gas and purge gas, with *Jurmann*, which describes a purge gas of argon or nitrogen in a substantially different process that does not include a carrier gas, does not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, said method comprising chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas, purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein, and controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents, and the purge gas is argon and the carrier gas is hydrogen, as recited in claim 27. Applicants respectfully request withdrawal of the rejection of claims 27, 29, and 30.

Conclusion

In conclusion, *Werkhoven, et al.* and *Jurmann*, alone or in combination, do not teach, show, or suggest a method for forming a layer on a substrate disposed in a processing chamber, the method comprising chemisorbing onto the substrate alternating monolayers of a first compound and a second compound, with the second compound having fluorine atoms associated therewith, with each of the first and second compounds being introduced into the processing chamber along with a carrier gas, purging the processing chamber following chemisorption of each of the alternating monolayers, wherein the purging the processing chamber includes introducing a purge gas therein, and controlling a quantity of the fluorine atoms associated with the monolayer of the second compound as a function of the carrier gas, wherein the purge gas and the carrier gas have differing constituents. Furthermore, *Werkhoven, et al.* and *Jurmann*, alone or in combination, do not teach, show, or suggest a process for depositing monolayers on a substrate, wherein a purge gas of argon and a carrier gas of nitrogen or hydrogen is used. Therefore, it is believed that the rejections made by the Examiner should be reversed. Thus, Applicants respectfully request reversal of the rejection and allowance of claims 1-4, 7, 8, 10, 12, 13, 23, and 26-30.

Respectfully submitted,



Keith M. Tackett
Registration No. 32,008
MOSER, PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd. Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Attorney for Applicant(s)

APPENDIX

1. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

chemisorbing onto said substrate alternating monolayers of a first compound and a second compound, with said second compound having fluorine atoms associated therewith, with each of said first and second compounds being introduced into said processing chamber along with a carrier gas;

purging said processing chamber following chemisorption of each of the alternating monolayers, wherein the purging said processing chamber includes introducing a purge gas therein; and

controlling a quantity of said fluorine atoms associated with the monolayer of said second compound as a function of said carrier gas, wherein the purge gas and the carrier gas have differing constituents.

2. (Previously Presented) The method of claim 1 wherein controlling said quantity of said fluorine atoms further includes selecting said carrier gas from a group of gases consisting of nitrogen (N_2), argon (Ar), hydrogen (H_2).

3. (Original) The method as recited in claim 1 wherein said first compound includes a boron-containing compound.

4. (Previously Presented) The method of claim 1 wherein said second compound includes a refractory metal selected from the group consisting of titanium (Ti) and tungsten (W).

7. (Previously Presented) The method as recited in claim 1 wherein purging said processing chamber includes pumping said processing chamber to evacuate all gases disposed therein.

8. (Previously Presented) The method as recited in claim 1 wherein purging of said processing chamber includes pumping said processing chamber clear of all gases disposed therein after introducing the purge gas.

10. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

serially exposing said substrate to first and second reactive gases, with said first reactive gas having a first compound associated therewith and said second reactive gas having a second compound associated therewith, to form alternating monolayers of said first compound and said second compound, with said second compound having fluorine atoms associated therewith;

controlling a quantity of said fluorine atoms associated with the monolayer of said second compound by introducing into said processing chamber a carrier gas along with said first and second reactive gases; and

purging said processing chamber following chemisorption of each of the alternating monolayers by introducing a purge gas, wherein the purge gas and the carrier gas have differing constituents.

12. (Previously Presented) The method as recited in claim 10 wherein purging said processing chamber includes pumping said processing chamber to evacuate all gases disposed therein.

13. (Previously Presented) The method as recited in claim 12 wherein said first compound includes diborane (B_2H_6) and said second compound is tungsten (W).

23. (Previously Presented) A method for forming a layer on a substrate disposed in a processing chamber, said method comprising:

serially exposing said substrate to first and second reactive gases to deposit monolayers on the substrate, with said first reactive gas having fluorine atoms associated therewith;

controlling a quantity of said fluorine atoms associated with the monolayers by introducing into said processing chamber hydrogen (H_2) as a carrier gas along with said first and second reactive gases; and

purging said processing chamber following deposition of each of the monolayers by introducing a purge gas, wherein the purge gas and the carrier gas have differing constituents.

26. (Previously Presented) The method of claim 1, wherein the purge gas is argon and the carrier gas is nitrogen.

27. (Previously Presented) The method of claim 1, wherein the purge gas is argon and the carrier gas is hydrogen.

28. (Previously Presented) The method of claim 10, wherein the purge gas is argon and the carrier gas is nitrogen.

29. (Previously Presented) The method of claim 10, wherein the purge gas is argon and the carrier gas is hydrogen.

30. (Previously Presented) The method of claim 23, wherein the purge gas is argon.